$Mw(\beta)/Mw(b) \leq 1.2$ (IV)

wherein Mw(α): weight average molecular weight of polymer (α),

Mw(β): weight average molecular weight of polymer (β),

Mw(a): weight average molecular weight of block (a) of block copolymer, and

Mw(b): weight average molecular weight of block (b) of block copolymer.

AB

REMARKS

Claims 1-7 are pending. Claims 1-17 are rejected. Claims 1, 2, 8 and 14 are amended. Support for the amendments can be found throughout the application, for instance at page 6 of the specification and in the claims as originally filed. No new matter is added. Claims 1-17 are submitted for further consideration. Applicants respectfully request reconsideration and withdrawal of all rejections.

Claim Rejections - 35 U.S.C. § 112, second paragraph

Claims 1-17 are rejected as being indefinite. The Office Action states that it is unclear whether the phrase "molecular weight" refers to weight or number average molecular weight. Applicants respectfully disagree as the meaning of the phase "molecular weight" is well known to those of ordinary skill in the art. Nevertheless, Applicants point out that the claims have been amended as indicated herein so as to as to clarify the invention and thereby advance prosecution. Applicants urge that those of

ordinary skill in the art would understand the meaning of the phrases "molecular weight" and "weight average molecular weight", as they continue to be used in the claims.

The Office Action states that the parameters S_A, S_B, S_α and S_β are not defined. Applicants respectfully disagree. Applicants point out that S_A, S_B, S_α and S_β are clearly defined by equations (I), (II), (III) and (IV), respectively (*See e.g.,* specification at pages 3 and 4). The specification also provides numerous examples of what is meant by polymers (α) and (β) as well as polymer phases (A) and (B) (See id. at pages 8-9). Those of skill in the art would clearly understand the meaning of these parameters. Nevertheless, the claims have been amended as indicated herein to delete the S_A, S_B, S_α and S_β parameters, so as to advance prosecution in this application.

The Office Action further states that in claim 14, it is unclear whether the polymer is chosen from polymer α or from polymers α and β. Applicants point out that claim 14 has been amended, as indicated herein. Applicants urge that claim 14 is clear and definite.

Finally, the Office Action states that the claim term "low" molecular weight is subjective and therefore unclear. Applicants respectfully disagree as the specification clearly discloses what is meant by "low" molecular weight. Indeed, the specification discloses how those of ordinary skill in the art may obtain the "low" molecular weights of the present invention. For example, the specification indicates that the molecular weights of the "low" molecular weight portions of the polymers forming the polymer phases (A) and (B) mean those values of molecular weights (*i.e.,* $Mw_{30}(A)$ and $Mw_{30}(B)$) corresponding to 30% of the cumulative area when converting the curve of the

distribution of the molecular weight measured by GPC as shown in Figure 1 to the integrated molecular weight curve as shown in Figure 2 (*See* specification at page 6, lines 28-35). The specification even provides examples of measurement by GPC (*See id.* at page 6, line 36 to page 7, line 3). Nevertheless, claim 1 has been amended including the deletion of the phrase "low" molecular weights, as indicated herein, so as to more clearly set forth this aspect of the present invention and advance prosecution. Applicants urge that those of ordinary skill in the art would understand the claims when read in view of the application as a whole.

Claim Rejections - 35 U.S.C. §§ 102(b)/103(a)

Claims 1-17 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Kawauzura et al. (U.S. Patent No. 5,679,744). The Office Action alleges that Kawauzura et al. discloses a composition wherein two different incompatible rubbers are blended with an AB block copolymer which is compatible with one rubber component and incompatible with the other.

Applicants respectfully disagree. The present invention is directed to a rubber composition suitable for use in rubber parts such as tire tread and sidewalls and having improvements as to tensile strength, elongation and abrasion resistance. The present invention is thus directed to the compounding of certain block copolymers having specified relationships for the molecular weights between the matrix polymers and the corresponding block of the block copolymer. The present invention is neither taught nor suggested by the disclosure of Kawauzura et al.

Applicants point out that Kawauzura et al discloses a rubber composition comprising:

(i) at least one rubber selected from the group consisting of styrene-butadiene copolymer rubbers (SBR);

(ii) at least one rubber selected from the group consisting of styrene-butadiene copolymer rubbers (SBR) and/or polybutadiene rubbers (BR) which is incompatible with the above SBR component (i); and

(iii) an A-B type block copolymer composed of

- a block A comprising a styrene-butadiene copolymer (SBR) or polyisoprene (IR), and

- a block B comprising a styrene-butadiene copolymer (SBR) or polybutadiene (BR) (*See* col. 4, lines 22-54).

Kawauzura et al. also teaches that block A is compatible with the SBR component (i) and incompatible with the SBR and/or BR component (ii), while block B is compatible with the SBR or BR component (ii) and incompatible with the SBR component (i) (*See id.*).

Applicants respectfully submit that Kawauzura et al. contains no teaching or suggestion regarding any polymer satisfying the equations (I) and (II) (See e.g., claim 1) or equations (III) and (IV) (See e.g., claims 8 and 14), as is required by the claimed invention. Although the Patent Office appears to be of the opinion that Kawauzra et al. discloses a composition in which two different incompatible rubbers having the specified Tgs are blended with an A - B block copolymer, this reference contains absolutely no

teaching or suggestion regarding any block copolymer having the specified relationships (I) and (II) or (III) and (IV). Applicants note in particular the Kawauzra et al. reference contains no teaching or suggestion regarding relationships wherein:

$Mw_{30}(A)/Mw(a) \leq 1.2$ (I)

$Mw_{30}(B)/Mw(b) \leq 1.2$ (II), or

$Mw(\alpha)/Mw(a) \leq 1.2$ (III)

$Mw(\beta)/Mw(b) \leq 1.2$ (IV)

Applicants emphasize that it is unfortunately not possible to perform any analysis of the claimed relationships (I) and (II) or (III) and (IV) with respect to the polymers of Kawauzra et al. as compared to the polymers of the present invention, since Kawauzra et al. fails to disclose certain data (e.g., molecular weight, molecular weight distribution) necessary for such analysis. In light of such inability of those of ordinary skill in the art to analyze the polymers of Kawauzra et al. with respect to the relationships claimed, Applicants point out that it would be incorrect to assert that that Kawasura discloses polymers satisfying such relationships. Applicants therefore respectfully submit that any determination of anticipation or obviousness in light of such a disclosure would also be improper.

Applicants further point out that Kawauzra et al. does not contain any teaching or suggestion as to the advantageous characteristics including improved tensile strength, elongation and abrasion resistance of the claimed compositions. Applicants point to the Table below which includes certain data with respect to abrasion resistance for the compositions as claimed as compared to the polymers of Kawauzra et al.

Table

		US '744			Present Invention
		TABLE I-1		TABLE I-2	Table II
		Example I-3		I-7 I-11	Ex. 1
NR	(Not defined)	45	45	45	-
NR-2	(SMR-L)	-	-	-	45
SBR	(ST/VN=25/35)	45	45	45	-
SBR	(NS114)	-	-	-	45
Block copolymer-I	(see below)	10	-	-	-
Block copolymer-II	(see below)	-	10	-	-
Block copolymer-III	(see below)	-	-	10	-
BP-3	(see below)	-	-	-	10
Anti-abrasion index		104	115	105	120

	Block A/B	BLOCK A				BLOCK B			
			Styrene Content (wt.%)	Vinyl Content (mol.%)	Molecular Weight		Styrene Content (wt.%)	Vinyl content (mol.%)	Molecular weight
Block copolymer-I	50/50	SBR	20	8		SBR	14	77	
Block copolymer-II	50/70	SBR	20	8		SBR	14	77	
Block copolymer-III	50/70	SBR	20	8		SBR	14	77	
BP-3		IR	Cis content =77 mol. %		3.1×10^5	SBR	18	11	3.21×10^5

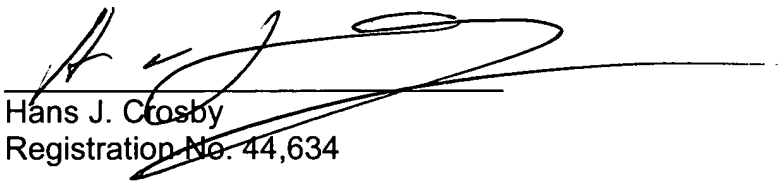
Reviewing this data, Applicants note that the anti-abrasion test indicates far superior results as to abrasion resistance for the claimed compositions as compared to copolymers of Kawauzra et al. Applicants point out in particular that the anti-abrasion test results in an abrasion index of 120 for the claimed compositions (Example 1) as

compared to an index of 104, 115 and 105 for the copolymers of Kawauzra et al. Applicants therefore submit that the data indicates that the present invention provides for compositions which are vastly superior as to certain characteristics when compared to the compositions of the Kawauzra et al. reference. In other words, the claimed compositions should be considered patentable by virtue of at least these unexpected results not taught or suggested by the cited reference.

In light of the discussion above, Applicants respectfully submit that the claimed invention is in condition for allowance.

In case this paper is not timely filed, the undersigned hereby petitions for an appropriate extension of time. Please charge any fee deficiency or credit any overpayment to Deposit Account No. 01-2300.

Respectfully submitted,



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MARKED UP COPY OF AMENDED CLAIMS

1. (Amended) A rubber composition comprising (i) an incompatible polymer blend comprising at least two diene rubbers selected from the group consisting of rubbers containing at least one conjugated diene monomer and, optionally, at least one aromatic vinyl monomer and forming two incompatible polymer phases (A) and (B) and (ii) 0.1 to 20 parts by weight, based upon 100 parts by weight of the total polymer component including the block copolymer, of a block copolymer having at least two mutually incompatible blocks (a) and (b) in which the block (a) is compatible with the polymer phase (A) and incompatible with the polymer phase (B) and the block (b) is compatible with the polymer phase (B) and incompatible with the polymer phase (A), and comprising at least one conjugated diene monomer and, optionally, at least one conjugated diene monomer, wherein the [molecular weights of the] polymers forming the polymer phases (A) and (B) satisfy the following equations (I) and (II):

$Mw_{30}(A)/Mw(a) \leq 1.2$ (I)

$Mw_{30}(B)/Mw(b) \leq 1.2$ (II)

[$S_A = Mw_{30}(A)/Mw(a) \leq 1.2$ (I)

$S_B = Mw_{30}(B)/Mw(b) \leq 1.2$ (I)]

wherein $Mw_{30}(a)$: a value of molecular weight corresponding to 30% of the cumulative area when converting the curve of the distribution of the molecular weight measured by

GPC to the integrated molecular weight curve [molecular weight of the low molecular weight portion] of the polymer forming the polymer phase (A),

$Mw_{30}(B)$: a value of molecular weight corresponding to 30% of the cumulative area when converting the curve of the distribution of the molecular weight measured by GPC to the integrated molecular weight curve [molecular weight of the low molecular weight portion] of the polymer forming the polymer phase (B),

Mw(a): weight average molecular weight of block (a) of block copolymer, and

Mw(b): weight average molecular weight of block (b) of block copolymer.

2. (Amended) A rubber composition as claimed in claim 1, wherein 5 to 200 parts by weight, based upon 100 parts by weight of the block copolymer, of polymer (α) compatible with the block (a) and the polymer phase (A) and/or polymer (β) compatible with the block (b) and polymer phase (B) are further blended and the weight average molecular weights of the polymers (α) and (β) satisfy the following equations (III) and (IV):

$$Mw(\alpha)/Mw(a) \leq 1.2 \qquad \text{(III)}$$

$$Mw(\beta)/Mw(b) \leq 1.2 \qquad \text{(IV)}$$

$$[\ S_\alpha = Mw(\alpha)Mw(a) \leq 1.2 \qquad \text{(III)}$$

$$S_\beta = Mw(\beta)/Mw(b) \leq 1.2 \qquad \text{(IV)}\ ]$$

wherein Mw(α): weight average molecular weight of polymer (α)

Mw(β): weight average molecular weight of polymer (β),

Mw(a): weight average molecular weight of block (a) of block copolymer, and

Mw(b): weight average molecular weight of block (b) of block copolymer.

8. (Amended) A rubber composition comprising (i) an incompatible polymer blend comprising at least two diene-based rubbers selected from the group consisting of rubbers containing at least one conjugated diene monomer and, optionally, at least one aromatic vinyl monomer and forming two polymer phases (A) and (B) and (ii) 0.1 to 20 parts by weight, based upon 100 parts by weight of the total polymer component including the block copolymer, of block copolymer having at least two mutually incompatible blocks (a) and (b), in which the block (a) is compatible with the polymer phase (A) and incompatible with the polymer phase (B) and the block (b) is compatible with the polymer phase (B) and incompatible with the polymer phase (A), and comprising at least one conjugated diene monomer and, optionally, at least one aromatic vinyl monomer and (iii) 5 to 200 parts by weight, based upon 100 parts by weight of the block copolymer, [of at least one polymer selected from the group consisting] of a polymer (α) compatible with the block (a) and the polymer phase (A), [and] a polymer (β) compatible with the block (b) and polymer phase (B) and a mixture of the polymer (α) and the polymer (β), wherein the weight average molecular weights of the polymers (α) and (β) satisfy the following equations (III) and (IV):

$\underline{Mw(\alpha)Mw(a) \leq 1.2}$ $\underline{(III)}$

$\underline{Mw(\beta)/Mw(b) \leq 1.2}$ $\underline{(IV)}$

[$S_\alpha = Mw(\alpha)Mw(a) \leq 1.2$ (III)

$S_\beta = Mw(\beta)/Mw(b) \leq 1.2$ (IV)]

wherein Mw(α): weight average molecular weight of polymer (α),

Mw(β): weight average molecular weight of polymer (β),

Mw(a): weight average molecular weight of block (a) of block copolymer, and

Mw(b): weight average molecular weight of block (b) of block copolymer.

14. (Amended) A rubber composition comprising 100 parts by weight of a block copolymer having at least two mutually incompatible blocks (a) and (b) and composed of at least one conjugated diene monomer and, optionally, at least one aromatic vinyl monomer and 5 to 200 parts by weight of [at least one polymer selected from the group consisting of] a polymer (α) compatible with the block (a), and a polymer (β) compatible with the block (b) <u>and/or a mixture of the polymer (α) and the polymer (β)</u>, wherein the weight average molecular weights of the polymers (α) and (β) satisfy the following equations (III) and (IV):

$\underline{Mw(\alpha)Mw(a) \leq 1.2}$ $\underline{(III)}$

$\underline{Mw(\beta)/Mw(b) \leq 1.2}$ $\underline{(IV)}$

$[\ S_\alpha = Mw(\alpha)Mw(a) \leq 1.2$ (III)]

$[\ S_\beta = Mw(\beta)/Mw(b) \leq 1.2$ (IV)]

wherein $Mw(\alpha)$: weight average molecular weight of polymer (α),

$Mw(\beta)$: weight average molecular weight of polymer (β),

Mw(a): weight average molecular weight of block (a) of block copolymer, and

Mw(b): weight average molecular weight of block (b) of block copolymer.